AERODONTALGIA UNDER HYPERBARIC CONDITIONS

WILLIAM R. SHILLER,
Lieutenant Commander (DC) USN
Submarine Medical Center, New London,
Groton, Conn.

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An analysis of forty-five case histories

William R. Shiller, Lieutenant Commander (DC) USN

SUBMARINE MEDICAL CENTER, NEW LONDON, GROTON, CONN.

Aerodontalgia was a subject of great interest during World War II, when men were first being subjected in large numbers to changes in ambient pressures. Past studies were concerned largely with the analysis of case histories of men who experienced dental pain while flying or during decompression tests. Orban and Ritchie[1] and Harvey[2] reported studies based on histologic examinations of teeth extracted after patients had experienced aerodontalgia.

Previous authors have not been in full agreement concerning the causes of aerodontalgia. Stewart and Macintosh[3] found that most of their cases occurred in filled teeth without adequate insulation or in teeth with infected root canals. Joseph and co-workers[4] concluded that aerodontalgia in the decompression chamber was caused by the reaction of vital pulps of carious teeth and by the reaction of degenerated gangrenous pulps. Harvey[2] thought that any pathologic condition of the tooth or its surrounding structures might give rise to aerodontalgia. He reported histologic studies which showed bubble formation in small vessels of the pulps of involved teeth. Orban and Ritchie[1] concluded that bubble formation was a common finding in pathologically involved pulps in cases of aerodontalgia. It was their opinion that open carious lesions, defective fillings, or the presence of air under fillings were not causative factors in aerodontalgia. They concluded definitely that a tooth with a normal pulp will not hurt under decompression, regardless of whether the tooth itself is intact, carious, or filled.

The low incidence of aerodontalgia reported (1.2 to 1.8 per cent) raised the question of why more teeth did not give rise to this problem. Reynolds and co-workers[5] reported that when fourteen persons with major dental pathologic

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conditions were subjected to a decompression test, no episodes of aerodontalgia were experienced. They found that the incidence of pain was closely related to maxillary sinus problems. In a subsequent experiment, Hutchins and Reynolds[6] found that when the walls of the maxillary sinus were stimulated, pain was experienced in recently restored teeth in the area of the sinus. It was concluded that the process of cutting tooth substance and placing a restoration in a tooth often results in some residual irritation to the pulp. The irritations might cause a subliminal neural response. When an area such as the wall of the maxillary sinus, which is supplied by closely related afferent neurons, is stimulated, the summation effect causes the previous subliminal response to exceed the pain threshold and odontalgia is experienced. Hutchins and Reynolds explained the stimulation of the maxillary sinus on the basis of nonequalization of pressure within the sinus, and they reported that this occurred most frequently during descent.

The pressure changes under which prior studies of aerodontalgia were conducted were only to the extent of about 10 psi or 30,000 feet of altitude. The prospective submariner must pass a pressure test involving a pressure change of 44 psi, or 100 feet of depth. In view of this rather great change in pressure, it was decided that some attempt should be made to evaluate aerodontalgia occurring under hyperbaric conditions to determine the extent of the problem and to ascertain whether the knowledge gained in aviation dentistry would apply to submarine dentistry.

METHODS

This study is confined solely to the case histories of men who experienced aerodontalgia of such severity that they sought dental consultation. The case histories were collected between 1961 and 1964 at the United States Naval Submarine Base, New London, Groton, Connecticut. The pressure tests were a routine requirement for entrance in the basic submarine school. The simulated test depths were 100 feet, or 58 pounds per square inch total pressure.

The case histories included notations as to location of involved tooth, presence of a restoration, past history of pain in the tooth, whether the pain began upon descent or ascent, duration of pain, presence of sinusitis, presence of a cold, and type of pain. No significant carious lesions were present in the men, for all teeth had been restored as one of the requirements for entering submarine service. The data in the case histories were collected by questioning, by clinical examination, and by roentgenograms.

RESULTS

A total of forty-five case histories were available for analysis. The ages ranged from 17 to 36 years, with a mean of 21 years. The data are summarized in Table I. No control data were available for comparison; therefore, only selected factors were analyzed for statistical significance. From the data, it can be seen that in this series of cases aerodontalgia tended to be confined to the maxillary arch. Of the six segments, the two maxillary posterior quadrants were most often affected. The pain usually began during descent and ceased

Table I. Frequencies of case history factors (N = 45 men)

Factor	*Frequency (per cent)*
Area of the mouth involved	
Maxillary arch	64*
Mandibular arch	36
Maxillary posterior segments	54†
Restorations present in involved teeth	89
Restorations present in involved segment	97
Positive history of past pain in involved area	27
Stage of test at which pain began	
Descent	74‡
Ascent	26
Duration of pain	
Pain had ceased upon surfacing	69
Pain stopped within one day	6
Pain lasted more than one day	25
Sinusitis present	37
Cold present	83
Characterization of pain	
Dull	32†
Sharp	68

*Not statistically significant, but a trend is present ($P < .1$).
†Statistically significant ($P < .05$).
‡Statistically significant ($P < .01$).

during the test or upon surfacing. The pain was most often characterized as sharp in nature. There was a high incidence of restorations in the involved teeth and areas, as well as a high incidence of colds and sinusitis, but these factors have little meaning without comparative data from the parent population.

When data were analyzed for interrelationships between factors in the case histories, only one pair of factors was significantly related ($P < .05$). The men having sinusitis had a greater incidence of pain upon descent than during ascent when compared with aerodontalgia sufferers free of sinusitis. A trend was noted in that the men with colds experienced a greater incidence of pain localized in the maxillary posterior segments than did the men who were free of colds.

DISCUSSION AND CONCLUSIONS

It is obvious that this study of aerodontalgia case histories does not completely answer the questions presented in the introduction. It seems that the data do indicate that the maxillary sinus plays a role in causing this pain.

The predominating localization of pain in the maxillary posterior segment, the incidence of pain on descent, and the sharp nature of the pain would seem to support the views of Hutchins and Reynolds[6] and of Reynolds and associates[5] that the maxillary sinus plays a role in initiating aerodontalgia. From this standpoint, it is concluded that there is no apparent difference between the aerodontalgia problem in the hyperbaric conditions of the submarine pressure test and the hypobaric conditions of the aviation decompression tests. Additional, controlled studies will be necessary to evaluate fully the role of other factors in producing aerodontalgia under hyperbaric conditions.

SUMMARY

1. Case histories of forty-five men who experienced aerodontalgia while undergoing pressure tests at the Submarine Base, New London, Groton, Connecticut, were analyzed.

2. It is highly probable that pressure involvement of the maxillary sinus had a role in producing aerodontalgia in a large number of the cases.

3. The role of other factors in producing aerodontalgia was not clarified by this case history analysis but awaits clarification in future controlled studies.

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